

NOMENCLATURAL AND SYSTEMATIC REASSESSMENT OF  
*OPUNTIA ENGELMANNII* AND *O. LINDHEIMERI*  
(CACTACEAE)

BRUCE D. PARFITT and DONALD J. PINKAVA  
Department of Botany, Arizona State University,  
Tempe 85287-1601

ABSTRACT

For more than 100 years the conspicuous, large prickly-pear of the Southwest was known as Engelmann Prickly-pear, *Opuntia engelmannii* Salm-Dyck. In 1965 Benson and Walkington placed the name in synonymy under *O. ficus-indica* (L.) Miller and proposed *O. phaeacantha* Engelm. var. *discata* (Griffiths) L. Benson and Walkington for the Engelmann Prickly-pear. Newly discovered morphological characters, especially a unique glochid arrangement within areoles, and restudy of the publication dates shows the correct name for the Engelmann Prickly-pear to be *Opuntia engelmannii* Salm-Dyck ex Engelm. Certain other taxa were found to share the glochid arrangement, in addition to other characters, warranting revised synonymy and the following new combinations: *O. engelmannii* var. *lindheimeri*; *O. engelmannii* var. *linguiformis*; *O. engelmannii* var. *flavispina*; and *O. engelmannii* var. *flexospina*.

RESUMEN

Por más de cien años el nopal grande y conspicuo del suroeste de los Estados Unidos ha sido conocido como "Engelmann Prickly-pear," *Opuntia engelmannii* Salm-Dyck. En el año 1965 Benson y Walkington reconocieron este nombre como sinónimo de *O. ficus-indica* (L.) Miller y propusieron para el "Engelmann Prickly-pear" el nombre *O. phaeacantha* Engelm. var. *discata* (Griffiths) L. Benson y Walkington. Caracteres morfológicos recientemente descubiertos, especialmente una distribución única de glóquidas adentro de las areolas, y un nuevo estudio de las fechas de publicación, muestra que el nombre correcto para el "Engelmann Prickly-pear" es *O. engelmannii* Salm-Dyck ex Engelm. Algunos otros taxa tienen en común con *O. engelmannii* la distribución de glóquidas y otros caracteres obligando a una revisión de sinonimia y a las combinaciones nuevas siguientes: *O. engelmannii* var. *lindheimeri*; *O. engelmannii* var. *linguiformis*; *O. engelmannii* var. *flavispina*; and *O. engelmannii* var. *flexospina*.

The Engelmann Prickly-pear was discovered by Wislizenus on his expedition through northern Chihuahua in 1846. Duplicate specimens were made available to Salm-Dyck and Engelmann. Engelmann's notes packaged on the lectotype read in part, "Original specimen . . . A shoot of this specimen was sent to Pr. Salm and described by him." Engelmann (1850) published his own description which differs significantly from that of Salm-Dyck (1850), under the name *Opuntia engelmannii* Salm-Dyck. Although Engelmann considered Salm-Dyck to be the author of the name (as "Salm. Mss."), his publication appeared in January 1850 (Stafleu and Cowan 1976), four months before Salm-Dyck's publication date (Salm-Dyck 1850,

Stafleu and Cowan 1985). Because Engelmann's paper has priority and because he attributed the name to Salm-Dyck, the correct full author citation of the name according to ICBN Art. 46.1, and Rec. 46E.1 (Voss et al. 1983) is *Opuntia engelmannii* Salm-Dyck ex Engelm.

The name, *O. engelmannii*, remained in wide usage for the conspicuous, large prickly-pear of the Southwest until 1965 when Benson and Walkington stated that the type represents a spiny individual ("*O. megacantha*") of the cultivated, usually spineless species, *O. ficus-indica* (L.) Miller. They placed *O. engelmannii* and *O. megacantha* Salm-Dyck in synonymy under *O. ficus-indica* and applied *O. phaeacantha* Engelm. var. *discata* (Griffiths) Benson and Walkington to the wild material, which continued to bear the common name, Engelmann Prickly-pear.

#### DISCUSSION

Upon examination of the morphological characters of *O. phaeacantha* var. *discata*, spiny and non-spiny forms of *O. ficus-indica*, and the lectotype of *O. engelmannii*, we discovered several characters apparently overlooked by Benson and Walkington. We found no significant differentiating morphological characters between the lectotype of *O. engelmannii* and *O. phaeacantha* var. *discata*; we consider them conspecific.

However, the following characters distinguish *O. engelmannii* from *O. ficus-indica*: areoles on pericarp 12–35 vs. 40–70; shrub habit vs. tree habit; glochids (within each areole on the middle of a stem-segment) conspicuous, 3–5 or more mm long, stout, of unequal lengths and widely spaced, generally throughout the areole (Fig. 1), vs. cryptic (even in spiny forms), less than 1.5 mm long, and in a tiny crescent near the apical margin of the areole (sometimes a few subapical, hidden in the wool) (e.g., McLeod 1255, OBI; Millspaugh 4523, NY; Stover 195, SD; Vanderwier s.n., OBI); and  $2n=66$  ( $2n=22$  for var. *cuija*) vs.  $2n=88$  (Pinkava and McLeod 1971, Pinkava et al. 1973, Pinkava and Parfitt 1982). They cannot be distinguished on the basis of presence or absence of spines. Although spineless individuals of both species might have glochids reduced and inconspicuous, usually by removing the areole's tomentum the characteristic glochid pattern may be seen.

We do not agree with Benson and Walkington's interpretation that the type of *O. engelmannii* is from a cultivated plant. The label on lectotype reads: "hab. north of Chihuahua, common as high up as El Paso. 5–6 feet high. August 1846. A. Wislizenus, leg." A fruit packet reads: "largest species, North of Chihuahua, 5–6' high, also cultivated. Dr. Wislizenus, August 1846."

Britton and Rose (1919:148) wrote: "Salm-Dyck, who first studied

the species, doubtless had but a single specimen before him, and this or a duplicate is now in the herbarium of the Missouri Botanical Garden. This type specimen came from near Chihuahua City, from which place Dr. Rose has collected identical material. Dr. Engelmann, who published Salm-Dyck's name, described the plant as erect and 5–6 feet high, giving its range from Chihuahua City to Texas. These remarks of his were doubtless based on notes of Dr. Wislizenus, who collected the type and must have included more than one species; as Engelmann says it is both cultivated and wild, the cultivated plants doubtless referring to some of the many forms grown about towns and ranches." The lectotype specimen (MO) includes only a fruit and a half-stem-segment; there is no evidence that two species are included.

In regard to *O. ficus-indica*, Britton and Rose (1919:177–178) stated: "Dr. Griffiths has recently figured a reversion which appeared on the common spineless form which points very definitely to *O. megacantha* as the origin of this form." Benson (1982:517–518) wrote: "These two plants [*O. ficus-indica* and *O. megacantha*] were quite similar, and the evolutionary origin of those known as *O. ficus-indica* from those called *O. megacantha* (as the wild type) was postulated by David Griffiths (*Journal of Heredity* 5:222. 1914)." In fact, Griffiths (1914) did not mention *O. megacantha*. Benson (1982: 932) further stated: "This name [*O. engelmannii*] has been applied erroneously to the large conspicuous prickly-pear occurring from the deserts of California to those of Texas but the type is from a cultivated individual of the spiny '*Opuntia megacantha*' type." We interpret Wislizenus' note, "also cultivated," as saying that although he collected from a native (wild) plant of common distribution between northern Chihuahua and Texas, he also saw cultivated plants that, in his opinion, were of the same species.

Specimens collected in 1976 northeast of Ciudad Chihuahua (e.g., Mexico, Chihuahua, Rte 10, 2.4 mi e. of Buenaventura, 4950 ft elev., Pinkava et al. 13223, ASU 86565, 86566) very closely match the lectotype of *O. engelmannii*. These plants were neither under cultivation nor appear to have escaped; habit and young fruit were that of the wild Engelmann Prickly-pear, not that of *O. ficus-indica*. From photos, these plants are estimated to be from 4–5 feet tall and more or less erect; in cultivation, one might easily expect the native plants to grow to 5–6 feet. If the lectotype were from the cultivated spiny form of *O. ficus-indica* as proposed by Benson (1965, 1982), we would expect it to reach 10–12 or more feet in cultivation.

Therefore, we do not consider *O. engelmannii* as conspecific with *O. ficus-indica*. We are recognizing *O. ficus-indica* in the sense of Britton and Rose (1919) but including forms that differ only in the presence of spines.

*Opuntia ficus-indica* and *O. megacantha* have not been typified. *Opuntia megacantha*, known only from an inadequate description,

would require the selection of a neotype before this name could be applied to *O. ficus-indica*, which has priority. *Opuntia megacantha* predates *O. engelmannii* but until typified, *O. megacantha* plays no role in our decisions.

*Opuntia lindheimeri* Engelm. shares with *O. engelmannii* the glochid arrangement, fruit color, habit, "hairy" seedlings, and lack of red bases on yellow inner perianth segments (though some flowers have the perianth completely red, orange, etc.). There are relatively subtle differences between these taxa, warranting no more than varietal status for *O. lindheimeri*. In variety *lindheimeri* the chalky-white outer layer of the spines (as found in var. *engelmannii*) is absent or nearly so, allowing the translucent yellow core to be conspicuous, and the fruit is pyriform or rather abruptly narrowed at the base instead of barrel-shaped.

*Opuntia engelmannii* is distinguished from *O. phaeacantha* sensu stricto by the following characters: fruit internally red-purple vs. green; inner perianth segments completely yellow vs. yellow with red bases; taller habit; spines of seedlings long and hair-like; and glochids (within each areole on the middle of a stem-segment) stouter, of unequal lengths and widely spaced, generally throughout the areole (Fig. 1), vs. compacted into a dense crescent-shaped tuft at the apex of the areole and, at least in more mature areoles, a prominent columnar tuft near the center of the areole (Fig. 1). Although intermediate specimens occur, especially in some populations of Arizona, Nevada, and California, we recognize *O. phaeacantha* as distinct from *O. engelmannii*. We do not recognize varieties of the former.

The discovery of these suites of distinguishing characters necessitates recognition of *O. engelmannii* as a species distinct from *O. phaeacantha* and from *O. ficus-indica* but not specifically distinct from *O. lindheimeri*.

#### TAXONOMIC TREATMENT

*OPUNTIA ENGELMANNII* Salm-Dyck ex Engelm. in Engelm. & A. Gray, Boston J. Nat. Hist. 6:208. Jan 1850. Type: Mexico, Chihuahua, n. of Chihuahua, common as high up as El Paso. Aug 1846, *Wislizenus* 223 (Lectotype: MO 2015202! designated by Benson and Walkington [1965], photos ASU!, NY, POM).

*Opuntia engelmannii* Salm-Dyck, Cact. hort. dyck. 1849. Apr 1850. Illegitimate, later homonym (ICBN Art. 64). Type: duplicate material of type of *O. engelmannii* Salm-Dyck ex Engelm. None preserved (see Stafleu and Cowan, 1985).

1. *OPUNTIA ENGELMANNII* var. *ENGELMANNII*. Autonym created with the publication of *O. engelmannii* var. *cyclodes* Engelm. & Bigelow, Proc. Amer. Acad. Arts 3:291. 1856.



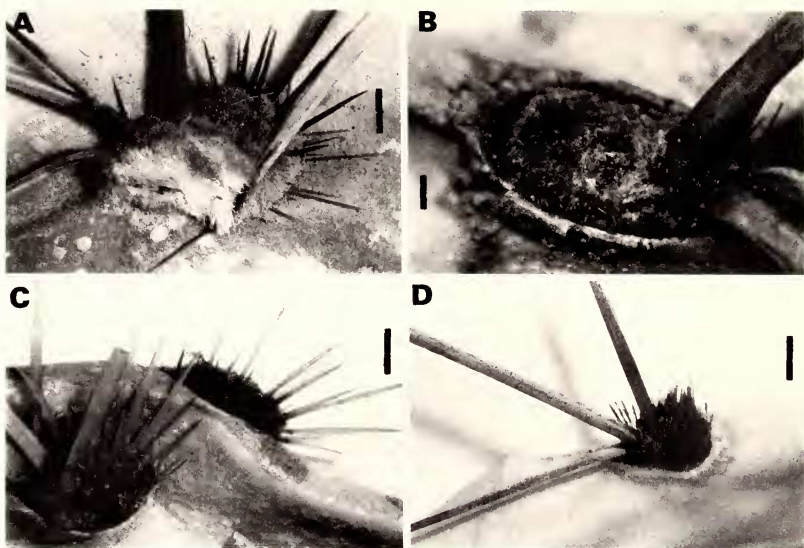


FIG. 1. Comparison of glochid arrangements of areoles midway between the base and apex of stem segments in four *Opuntia* taxa. A. *O. engelmannii* var. *engelmannii* (lectotype, *Wislizenus* 223, MO). B. *O. ficus-indica* (Stover 165, SD). C. *O. engelmannii* var. *lindheimeri* (topotype, Reeves 6333c sheet 2, ASU). D. *O. phaeacantha* (Worthington 10587, ASU). Scale line = 2 mm; placed at apical end of areole.

*Opuntia discata* Griffiths, Annual Rep. Missouri Bot. Gard. 19:265 + pl. 27 (upper fig.). 1908.—*O. engelmannii* Salm-Dyck var. *discata* C. Z. Nelson, Galesburg Republican Register, 20 Jul 1915; Trans. Illinois State Acad. Sci. 12:124. 1919.—*O. phaeacantha* Engelm. var. *discata* (Griffiths) L. Benson & Walkington, Ann. Missouri Bot. Gard. 52:265. 1965. Type: USA, AZ, foothills of the Santa Rita Mts, Apr 1905, Griffiths 7790 (Holotype: US 2572028A!, 2572029A!, 25720308A!, photos ASU!; isotype: POM 287144 [2 sheets]!, photos ASU!).

*Opuntia dillei* Griffiths, Annual Rep. Missouri Bot. Gard. 20:82–83 + pls. 2 (fig. 10), 4 (lower fig.), 13 (fig. 7). 1909. Type: USA, NM, San Andreas canyon of the Sacramento Mts, about 15 miles s. of Alamogordo, 3 Aug 1908, Griffiths 9460 (Holotype: US 2576308A!, 2576309A!, photos ASU!; isotype: POM 288128).

The names *O. engelmannii* and *O. lindheimeri* were simultaneously published (Engelmann 1850). Engelmann (1856) first treated the two as conspecific and placed *O. lindheimeri* into synonymy of *O. engelmannii*.

2. *Opuntia engelmannii* var. *lindheimeri* (Engelm.) Parfitt & Pinkava, comb. nov.—*O. lindheimeri* Engelm. in Engelm. & A.

Gray, Boston J. Nat. Hist. 6:207. Jan 1850.—*O. lindheimeri* Engelm. var. *lindheimeri*. Autonym created by Coulter (1896) with publication of *O. lindheimeri* var. *dulcis* (Engelm.) J. Coulter, var. *occidentalis* (Engelm. & Bigelow) J. Coulter, var. *cyclodes* (Engelm.) J. Coulter, and var. *littoralis* (Engelm.) J. Coulter. Type: USA, TX, New Braunfels, 1845, *Lindheimer s.n.* (Lectotype: MO 2016376! designated by Benson [1982], photo ASU!).

*Opuntia lindheimeri* Engelm. var. *lehmannii* L. Benson, Cact. Succ. J. (Los Angeles) 41:125. 1969. Type: USA, TX, Kleberg Co., King Ranch, 10 miles s. of ranch headquarters at Kingsville, 19 Apr 1965, *Lehman and Benson 16557* (Holotype: POM 317076! [4 sheets], photos ASU!).

*Opuntia tricolor* Griffiths, Annual Rep. Missouri Bot. Gard. 20:85–86 + pl. 4 (upper fig.). 1909.—*Opuntia lindheimeri* Engelm. var. *tricolor* (Griffiths) L. Benson, Cact. Succ. J. (Los Angeles) 41:125. 1969. Type: USA, TX, “prepared October 2, 1908, from cultivated specimens collected March 29, 1907, near Laredo,” *Griffiths 8651* (Holotype: US 2571220A!, photo ASU!; isotype: POM 287271; clonotypes: US 2571219A!, 2571221A!, photos ASU!).

*Opuntia subarmata* Griffiths, Ann. Rep. Missouri Bot. Gard. 20:94 + pls. 2 (fig. 1), 11, 13 (fig. 4). 1909.—[*O. engelmannii* Salm-Dyck var. *subarmata* Weniger, Cacti of the Southwest 180. 1970 (invalid name, ICBN Art. 33.2)].—*O. lindheimeri* Engelm. var. *subarmata* (Griffiths) Elizondo & Wehbe, Cact. Suc. Mex. 32: 16–18. 1987. Type: USA, TX, near Devils River, 22 Jul 1908, *Griffiths 9422* (Holotype: US 2572063A!, photo ASU!; isotype: POM 288607, 288608; clonotype: US 2572064A!, photo ASU!).

3. ***Opuntia engelmannii* var. *linguiformis*** (Griffiths) Parfitt & Pinkava, comb. nov.—*O. linguiformis* Griffiths, Annual Rep. Missouri Bot. Gard. 19:270. 1908.—*Opuntia lindheimeri* Engelm. var. *linguiformis* (Griffiths) L. Benson, Cact. Succ. J. (Los Angeles) 41:125. 1969.—[*Opuntia engelmannii* Salm-Dyck var. *linguiformis* (Griffiths) Weniger, Cacti of the Southwest 181. 1970 (invalid name, ICBN Art. 33.2)]. Type: USA, TX, near San Antonio, Aug 1906, *Griffiths 8377* (Holotype: US 2571222; isotypes: ASU 140761!, POM 317780).

[*Opuntia lindheimeri* Engelm. var. *brava* E. Schulz & Runyon, Trans. Texas Acad. Sci. 14:57. 1930 (invalid name, ICBN Art. 34.1a)]. For discussion of the name “var. *brava*,” see Benson (1969).

Variety *linguiformis* was considered by Schulz and Runyon (1930) to be a sterile mutant form. It is readily distinguishable by the lanceolate stem segments. In other characters it resembles var. *lindheimeri*. No native populations are known.

4. ***Opuntia engelmannii* var. *flavispina*** (L. Benson) Parfitt & Pinkava, comb. nov.—*O. phaeacantha* Engelm. var. *flavispina* L. Benson, Cact. Succ. J. (Los Angeles) 46:79. 1969. Type: USA, AZ, Pima Co., Organ Pipe Cactus National Monument, Ajo Mts, Alamo Canyon, 2300 ft, 27 Apr 1939, *Nichol s.n.* (Holotype: POM 306987; isotypes: ARIZ 64930, 83680; Herb. Organ Pipe Cactus Natl. Mon!; Herb. U.S. Natl. Park Service, Santa Fe).
5. **OPUNTIA ENGELMANNII** var. **CUIJA** Griffiths & Hare, New Mexico Agric. Exp. Sta. Bull. 60:44. 1906.—*Opuntia cuija* (Griffiths & Hare) Rose in Britton & Rose, Smithsonian Misc. Coll. 50:529. 1908.—*Opuntia lindheimeri* Engelm. var. *cuija* (Griffiths & Hare) L. Benson, Cact. Succ. J. (Los Angeles) 41:125. 1969. Type: Mexico, San Luis Potosi, *Griffiths 7596* (=7636) (Holotype: US 2576155A!, 2576156A!, photos ASU!; isotype: POM 287125).

Pinkava and Parfitt (1982) reported this taxon as diploid ( $2n=22$ ). The remainder of *O. engelmannii* is hexaploid ( $2n=66$ ). Although this taxon may be better treated as a species, we have chosen to treat it here pending resolution of the uncertainty regarding the application of *O. cantabrigiensis* Lynch, which has priority at the species level.

6. ***Opuntia engelmannii* var. *flexospina*** (Griffiths) Parfitt & Pinkava, comb. nov.—*O. flexospina* Griffiths, Bull. Torrey Bot. Club 43: 87. 1916.—[*O. engelmannii* Salm-Dyck var. *flexispina* [sic] (Griffiths) Weniger, Cacti of the Southwest 178. 1970 (invalid name, ICBN Art. 33.2)].—*O. strigil* Engelm. var. *flexospina* (Griffiths) L. Benson, Cact. Succ. J. (Los Angeles) 46:79. 1974. Type: USA, TX, vicinity of Laredo, dry gravelly hills, Jun 1911, *Griffiths 10301* (Holotype: US 2571224A!, 2571225A!, photos ASU!; isotypes: POM 299916, 290308).

## ACKNOWLEDGMENTS

Reviews of the nomenclature by Edward G. Voss and Dan H. Nicolson are greatly appreciated. Allan D. Zimmerman provided helpful comments and discussion, especially regarding the Texas taxa. Sonia and Leslie Landrum kindly translated the abstract to Spanish. We thank the curators of ARIZ, ASU, MO, NY, OBI, POM, SD, US, and the herbarium of Organ Pipe Cactus National Monument for making specimens available for study.

## LITERATURE CITED

- BENSON, L. 1969. The cacti of the United States and Canada—new names and nomenclatural combinations—I. Cact. Succ. J. (Los Angeles) 41:124–128.  
———. 1982. The cacti of the United States and Canada. Stanford Univ. Press, Stanford, CA.

- and D. L. WALKINGTON. 1965. The southern California prickly pears— invasion, adulteration, and trial-by-fire. *Ann. Missouri Bot. Gard.* 52:262–273.
- BRITTON, N. L. and J. N. ROSE. 1919. The Cactaceae. Vol. 1. Publ. Carnegie Inst. Wash. 248.
- COULTER, J. M. 1896. Preliminary revision of the North American species of *Echinocactus*, *Cereus*, and *Opuntia*. *Contr. U.S. Natl. Herb.* 3:355–462.
- ENGELMANN, G. 1850. Cactaceae. In G. Engelmann and A. Gray, *Plantae Lindheimerianae*. II. Boston *J. Nat. Hist.* 6:195–209.
- . 1856. Synopsis of the Cactaceae of the Territory of the United States and adjacent regions. *Proc. Amer. Acad. Arts* 3:259–346.
- GRIFFITHS, D. 1914. "Reversion" in prickly pears. *J. Heredity* 5:222–225.
- PINKAVA, D. J. and M. G. MCLEOD. 1971. Chromosome numbers in some cacti of western North America. *Brittonia* 23:171–176.
- , ———, L. A. MCGILL, and R. C. BROWN. 1973. Chromosome numbers in some cacti of western North America. II. *Brittonia* 25:2–9.
- and B. D. PARFITT. 1982. Chromosome numbers in some cacti of western North America. IV. *Bull. Torrey Bot. Club* 109:121–128.
- SALM-DYCK, J. ZU. 1850. Cactae in Horto Dyckensi Cultae Anno 1849. Bonn.
- SCHULZ, E. D. and R. RUNYON. 1930. Texas cacti. *Trans. Texas Acad. Sci.* 14:1–181.
- STAFLEU, F. and R. S. COWAN. 1976. Taxonomic literature, 2nd ed. Vol. 1: A–G. *Regnum Veg.* 94.
- and ———. 1985. Taxonomic literature, 2nd ed. Vol. 5: Sal–Ste. *Regnum Veg.* 112.
- VOSS, E. G., et al. 1983. International code of botanical nomenclature. *Regnum Veg.* 111.

(Received 13 Jun 1988; revision accepted 25 Aug 1988.)

## ANNOUNCEMENT

### NEW PUBLICATIONS

FERREN, W. R., D. G. CAPRALIS, and D. HICKSON, 1987, *University of California, Santa Barbara, Campus Wetlands Management Plan. Part I, Technical Report on the Botanical Resources of West and Storke Campuses*. A Report to the UCSB Wetlands Committee. Environmental Research Team, The Herbarium, Department of Biological Sciences, University of California, Santa Barbara. Environmental Report No. 12. 198 pp. \$10.00. (Including Devereux Slough and portions of Goleta Slough.)

APT, K., C. D'ANTONIO, J. CRISP, and J. GAUVAIN. 1988. *Intertidal Macrophytes of Santa Cruz Island, California*. The Herbarium, Department of Biological Sciences, University of California, Santa Barbara. Publication No. 6. 87 pp. \$8.00.

Orders should be sent to The Herbarium, Department of Biological Sciences, University of California, Santa Barbara 93106. Checks should be payable to The UCSB Foundation.